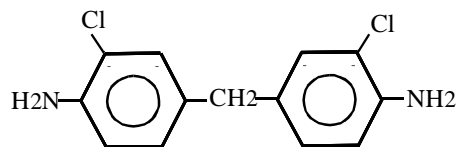


4,4'-METHYLENE BIS(2-CHLOROANILINE)

4,4'-Methylene bis(2-chloroaniline) is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 101-14-4

Molecular Formula: $C_{13}H_{12}Cl_2N_2$



4,4'-Methylene bis(2-chloroaniline) is composed of colorless crystals. It is only slightly soluble in water but soluble in alcohol, ether, most organic solvents, and lipids. When heated to decomposition, it emits toxic fumes of hydrochloric acid and other chlorinated compounds as well as nitrogen oxides (NTP, 1991).

Physical Properties of 4,4'-Methylene bis(2-chloroaniline)

Synonyms: 4,4'-methylene bis[2-chlorobenzenamine]; di-(4-amino-3-chlorophenyl)methane; 4-4'-diamino-3,3'-dichlorodiphenylmethane; methylenebis(o-chloroaniline); MOCA; DACPM

Molecular Weight:	267.15
Melting Point:	110 °C
Density/Specific Gravity:	1.44 at 25/4 °C (water = 1)
Vapor Pressure:	1.3×10^{-3} mm Hg at 60 °C
Log Octanol/Water Partition Coefficient:	3.94
Conversion Factor:	1 ppm = 10.9 mg/m ³

(HSDB, 1991; Merck, 1983; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

4,4'-Methylene bis(2-chloroaniline) is used in the manufacture of gun mounts, jet engine turbine blades, radar systems, and components in home appliances. It is also used as a curing agent for polyurethane elastomers, in curing urethane and epoxy resins, and crosslinking urethane foam (HSDB, 1991).

The primary stationary sources that have reported emissions of 4,4'-methylene bis(2-chloroaniline) in California are manufacturers of electronic components and accessories and manufacturers of miscellaneous chemical products (ARB, 1997b).

B. Emissions

The total emissions of 4,4'-methylene bis(2-chloroaniline) from stationary sources in California are estimated to be at least 80 pounds per year, based on data reported under the Air Toxics "Hot Spots" Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

4,4'-Methylene bis(2-chloroaniline) has not been reported to occur as a natural product (HSDB, 1991).

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of 4,4'-methylene bis(2-chloroaniline).

INDOOR SOURCES AND CONCENTRATIONS

No information about the indoor sources and concentrations of 4,4'-methylene bis(2-chloroaniline) was found in the readily-available literature.

ATMOSPHERIC PERSISTENCE

Atmospheric 4,4'-methylene bis(2-chloroaniline) will degrade by photolysis or reaction with photochemically produced hydroxy radicals. The estimated half life of 4,4'-methylene bis(2-chloroaniline) with its gas phase reaction with hydroxyl radicals is estimated to be a few hours (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics "Hot Spots" Program (AB 2588). Of the risk assessments reviewed as of April 1996, 4,4'-methylene bis(2-chloroaniline) was not listed in any of the risk assessments (OEHHA, 1996a).

HEALTH EFFECTS

Probable routes of human exposure to 4,4'-methylene bis(2-chloroaniline) are inhalation, ingestion, and dermal contact (U.S. EPA, 1994a).

Non-Cancer: Exposure to 4,4'-methylene bis(2-chloroaniline) can interfere with the ability of the blood to carry oxygen causing headaches, dizziness, nausea, and a bluish color to the skin and lips. Contact can irritate the eyes. Exposure to 4,4'-methylene bis(2-chloroaniline) also may cause methemoglobinemia (U.S. EPA, 1994a).

The United States Environmental Protection Agency (U.S. EPA) has not established an oral Reference Dose (RfD) for 4,4'-methylene bis(2-chloroaniline); however, they have calculated a provisional RfD of 7×10^{-4} milligrams per kilogram per day. The U.S. EPA estimates that consumption of this dose or less, over a lifetime, would not likely result in the occurrence of chronic non-cancer effects. The Reference Concentration (RfC) is under review by the U.S. EPA (U.S. EPA, 1994a).

No information is available on adverse developmental or reproductive effects of 4,4'-methylene bis(2-chloroaniline) in humans or animals (U.S. EPA, 1994a).

Cancer: Results from one epidemiological study of workers exposed to 4,4'-methylene bis(2-chloroaniline) were inconclusive. Oral exposure to test animals has been reported to cause tumors of the lung, liver, bladder, and mammary glands. 4,4'-Methylene bis(2-chloroaniline) has a chemical structure similar to benzidine, a known human bladder carcinogen, and to a potent animal carcinogen, 3,3'-dichlorobenzidine (U.S. EPA, 1994a).

The U.S. EPA has classified 4,4'-methylene bis(2-chloroaniline) as group B2: Probable human carcinogen (U.S. EPA, 1994a). The International Agency for Research on Cancer has classified 4,4'-methylene bis(2-chloroaniline) in Group 2A: Probable human carcinogen (IARC, 1987a).

The State of California has determined under Proposition 65 that 4,4'-methylene bis(2-chloroaniline) is a carcinogen (CCR, 1996). The inhalation potency factor that has been used as a basis for regulatory action in California is 4.3×10^{-4} (microgram per cubic meter)⁻¹ (OEHHA, 1994). In other words, the potential excess cancer risk for a person exposed over a lifetime to 1 microgram per cubic meter of 4,4'-methylene bis(2-chloroaniline) is estimated to be no greater than 430 in 1 million. The oral potency factor that has been used as a basis for regulatory action in California is 1.5 (milligram per kilogram per day)⁻¹ (OEHHA, 1994).

